RESIDENCE AND CHILDCARE ASSISTANCE AMONG THE TWE

by

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ABSTRACT

This document includes three papers from my research on residence among the Twe people of the Lower Kunene Region. The first paper gives an ethnographic account of the Twe. I discuss the Twe's mysterious and potentially unique ethnic history, their complex subsistence, and the ways in which their social organization differs from that of neighboring tribes. The second paper presents a simulation model that shows how we might expect the role of secondary childcare provider to shift from a woman's mother to her older daughters as she moves through her reproductive career. This dynamic might explain why women would want to remain in their natal camp until later in life. This is a common pattern among many traditional populations that is particularly relevant to the study of hunter-gatherers and other groups with limited heritable wealth. The final paper offers an empirical test of the relationship between childcare assistance and residence. Using genealogical and residence history data, I investigate whether women with young dependent children are more likely to live with their mothers. I also test whether women move away from home when they have babysitting daughters as predicted in the preceding simulation model. The findings in the third paper are consistent with both of these expectations.

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I would like to thank Steven Josephson for initially taking me to Northwest Namibia and assisting me in my efforts to establish a field site in the region. Without Steve's help, I would not be writing this dissertation. I would also like to thank the Müller family of Okahandja whose hospitality has been a constant comfort during my work in Namibia. I would also like to thank the Jakurama brothers of Opuwo for being both my field-guides and friends throughout this project. I owe a considerable debt to my wife Chelsea Leonard for taking the time to offer editing and wisdom even while overwhelmed with dissertation work of her own. Finally, I would like to thank the members of my committee for consistently making themselves available to offer guidance throughout my time in the department.

CHAPTER 1

INTRODUCTION

This dissertation discusses my work with the Twe people of the Lower Kunene Region in Namibia and Angola. I first encountered the Twe while working with Dr. Steven Josephson in the nearby Baynes Mountains. After interviewing some of the Twe near Epupa Falls, I hired a truck and traveled the region locating Twe households and collecting genealogical and demographic data. I was able to return to the field on multiple subsequent trips between 2009 and 2013 thanks to dissertation improvement grants from the National Science Foundation and the Wenner-Gren Foundation.

One of the striking patterns that came out of my initial data collection was that contrary to their stated rule of patrilocal residence, Twe couples are equally likely to live in the husband's or the wife's familial camp. This situation offered an excellent opportunity to investigate the factors shaping variability in residence decisions within populations. Postmarital residence is one of the oldest topics in anthropology. However, the literature is surprisingly lacking in explanations for the patterning of residence variability within populations. Instead, the vast majority of theory speaks to broad cultural factors that explain variation between societies.

Bringing our understanding of residence variability to the level of individuals and couples has important implications for understanding hunter-gatherers and other populations with limited heritable wealth. These groups are often characterized by highly flexible residence and understanding the patterning of that residence requires taking the perspective of individual agents. This dissertation takes a step towards describing these patterns by looking at residence from the perspective of women attempting to retain access to childcare assistance.

Chapter 2 gives an ethnographic account of the Twe people. I discuss some of the interesting confusion regarding their place in the region, outline the variety of subsistence practices the Twe use to survive in the harsh Lower Kunene environment, and note some of the differences between the Twe's social organization and that of their pastoralist Bantu neighbors. Most relevant to the focus of this dissertation is the observation that limited heritable wealth among the Twe allows women to assert more influence over decisions of marriage and residence.

Chapter 3 looks at a simulation model abstracted from the dynamics of cooperative childcare seen in humans. The goal of the model is to investigate the change in residence-dependent childcare over time. I find that women should have increasing freedom to respond to residence incentives other than childcare assistance as they progress through their reproductive careers. Women initially depend on their mothers as the key secondary childcare provider, but early-born daughters eventually begin to take over this role. A woman's daughters are a potential source of childcare assistance that she can take with her when she moves to a different location. This means that early-born daughters weaken the importance of childcare assistance as a constraint on residence.

Chapter 4 is an empirical study that uses residence history interviews and behavioral data collected among the Twe. The study investigates whether women's residence decisions map onto access to childcare assistance. I test whether women are more likely to live near their mothers when they have young children to care for, and whether they are more likely to move away from home once they have babysitting daughters. The findings of the study identify access to childcare assistance as an important factor shaping variability in residence, and support the model put forth in Chapter 2.

CHAPTER 2

BEYOND "TWA": *AN ETHNOGRAPHIC ACCOUNT OF THE TWE PEOPLE*

2.1 Introduction

The Twe are a population of approximately 3,000 people inhabiting the dry and mountainous region along the Lower Kunene River in Namibia and Angola. On initial impression, the Twe are nearly indistinguishable from their well-documented pastoralist neighbors, the Himba. Any difference in physical appearance is minor and their cultural traditions and aesthetics are largely identical. However, appearances and professed culture belie a different history and current daily life. The Twe are marginalized socially and economically as an outsider ethnic group, and they respond to the challenges posed by this situation with a distinct set of strategies.

The Twe are known in the literature as an ethnically isolated population. This has been the case since Carlos Estermann first described his encounter with them in 1958, and is consistent with local perception [1]. However, there has been limited progress towards understanding the deeper history of the Twe, and much of the initial rationale for identifying them as non-Bantu is unpersuasive. Section 2.2 gives a brief review of the confusion surrounding the Twe's ethnic background in order to consolidate what little is known, and set the stage for discussing how the constraints of the Twe's out-group designation impact their daily life.

The Twe live in a world of pastoralists, but few own significant herds of livestock. Instead, the Twe depend on a flexible set of subsistence options to survive in their harsh semi-arid desert environment. The Twe forage both for direct subsistence and trade goods, produce crafts, and devote considerable time to gardens during periods of heavy rain. Section 2.3 discusses these modes of subsistence, which are not only essential to understanding the Twe, but also highlight common strategies used throughout the region by less wealthy Bantus. These are subsistence strategies that are often ignored due to a focus on the pastoralist narrative.

In section 2.4, I discuss how the Twe's relative lack of animal wealth affects marriage, kinship, and residence practices. The Twe's explicit culture mirrors that of their pastoralist neighbors, but the ways in which actual behavior deviates from these ideals helps illuminate

the relationship between cattle-wealth and social organization. In particular, I address how Twe women exert more control over decisions about marriage and residence than their Bantu neighbors, which may lead to a diminished role for patrilineal institutions.

2.2 Who Are the Twe?

I use the ethnonym Twe in publication at the request of my hosts in the Otjitanga Valley. However, all previous literature refers to this population as the "Thwa," "Twa," "Tua," "Southern Twa," or "Highland Twa." Twe is an adjective that translates to "sharp" in the Otjiherero language. Informants claim this is an old label that speaks to their status as renowned hunters, but there is no historical record of a group identifying as Twe in the Kunene region. While the vintage of the "Twe" label is uncertain, the term "Twa" originated as a derogatory exonym. Twa is widely used across Bantu languages to pejoratively describe non-Bantu hunter-gatherers [2]. In spite of this, most informants continue to self-identify as Twa when asked to name their tribal affiliation. This complicates an already muddy ethnic history, because there are Twa groups living throughout sub-saharan Africa, including the Congo Basin, Zambia, and Botswana [3, 4] as well as the broader Kunene region, all of whom may share no history with the Twe beyond their subordinate status to Bantu pastoralists.

The Twe live among numerous Bantu tribes with whom they share a similar language and culture, but are considered the remnant of a pre-Bantu population [5, 1]. The initial justification for labeling the Twe as distinct from local Bantu tribes was based primarily on their limited dependence on food-production [1]. This reasoning should be called into question given historical accounts of the Twe's pastoralist Bantu neighbors shifting from food-production to foraging and client-service in times of need [6]. Early ethnographic researchers varied in their assessment of how the Twe compare physically to their Bantu neighbors, but anthropometric analyses place them as slightly shorter yet largely indistinguishable [1, 7, 8, 9, 10]. The final reason for placing the Twe outside of the local Bantu groups rests on their social position in the region and locally perceived ethnic affiliation.

Bantu pastoralists accuse the Twe of thievery and sorcery and label them as an inferior out-group. The Twe are considered impure and neither marriage nor sexual relations are allowed. Another issue commonly raised by informants is that the Himba turn away Twe who beg for *omaere* (sour milk) or at best give them *omatuka* (a buttermilk by-product of the sour milk process that is typically reserved for the dogs). Meanwhile, the similarly impoverished Tjimba, a group locally recognized as Himba who lost their cattle, are likely

to receive charity from other tribes. The severity of tribal animosity is such that Twe living outside of their core region often hide their ethnic identity, claiming instead to be Tjimba, Himba, or Zemba. This marginalization of the Twe could be the result of historical ethnic differences, but it may alternatively be a more recent phenomena resulting from the Twe's role in the local economy.

A significant portion of Twe subsistence comes from the trade of crafts and foraged goods, or client-services such as spiritual-healing and cattle-herding. This "peripatetic niche" is common across Africa and is consistently packaged with ideas of distrust and ritual impurity among the client tribes [11]. From this perspective, the Twe may simply be an economic caste within the local Bantu tribes rather than a biologically distinct population.

Assuming the Twe are in fact a non-Bantu population, they join other potentially non-Bantu and non-Khoisan groups living in Southern Africa. These include the "Black Bushmen" of the Northern Kalahari [12, 13, 14], the Damara or *Ovizorotwa* ("Black Twa") living throughout Namibia [15], the Tjimba-Tjimba of the Baynes Mountains [16, 17], the Kwisi or *Twa-Matari* ("Stone Twa") of the Moçâmedes Desert [1], and the Kwadi (also referred to as the Kwepe, Koroka, or Kwankwa) living along the Curoca River in southwestern Angola [18, 1]. This last group may be the most interesting with respect to the Twe.

The Curoca River empties at Porto Alexandre on the Atlantic Ocean after passing 20 kilometers north of Oncocua, the Twe hub in Angola. My informants consider the OvaKoroka ("people of the Curoca") as a part of their own tribe with whom they share a common dialect of the Herero language. All groups along the Curoca River now speak a Bantu language, but recordings of the traditional Kwadi language collected in the 1960s identify them as an isolated linguistic group [19]. Linguistic evidence argues that this population migrated into the region from East Africa bearing sheep and possibly cattle a few centuries before the Bantu [20, 21].

Alternative possibilities place the Twe as the remnants of a non-Herero Bantu migration, or a hunting and gathering population that preceded any pastoralist migrations into southern Africa. Hopefully, future genetic research will help place the Twe in the prehistory of northwest Namibia and southwest Angola. For now, I can only say that regardless of the path that brought them there, the Twe find themselves outside of the locally dominant Herero-Bantu tradition.

2.3 Surviving without Cattle

The Twe strive for a pastoralist subsistence like their neighbors, but few are able to realize this ideal. Thirty-seven percent of adult Twe men own at least one goat or cow, but most of these are small goat herds that function more as currency than a source of calories. Informants say that a household needs at least 10 cattle before livestock provide a stable source of calories (see [22] for more precise yield rates). Only 15% of Twe households reach this benchmark.

One reason why the Twe own so few cattle is that all of the best pasture is controlled by other tribes. The Twe in Namibia live in and around the Zebra Mountains, a range that gets its name from the black boulders striping its sides. These boulders are a serious hazard for cattle, which can slip and injure themselves while searching for grass. In addition, the mountains are notoriously filled with *Aristida* grasses (specifically *A. stipoides* and *A. stipitata*), a fast-growing genus that cattle find unpalatable. These conditions combine to make the area an inferior location for grazing. Furthermore, much of the land in the Twe territory that is suitable for grazing is actually owned by neighboring Himbas who bring cattle to graze once their home territory has been depleted. Twe are free to forage on this land while its owners are away, but will be punished according to Himba tribal law if they graze any animals.

Without cattle, the Twe must seek out other means of subsistence. To the limited extent that the Twe have been discussed in the ethnographic literature, the focus has been on their role as iron smiths. This accurately highlights one of the important features that distinguish them from their neighbors; however, it also presents the Twe only in their role as Himba service providers, effectively overshadowing the vast majority of their daily lives. Twe informants identify foraging and gardening as their primary sources of subsistence. However, crafting, animal husbandry, and recently government subsidy provide important sources of calories as well.

Throughout their history, the Twe have capitalized on opportunities to expand their subsistence options. Historically hunters of a broad range of fauna, the Twe took advantage of the Angolan ivory boom at the turn of the 19th century by specializing in elephant hunting [23, 24, 1]. This tradition died along with the local elephant population, but more recently, the Twe have transitioned towards iron smithing and other trade specializations. As pastoralist herds grow, they simultaneously constrain the yield of hunting through the competitive exclusion of game animals and open the novel resource of wealthy neighbors interested in trade and services. The Twe's flexibility allows them to subsist on gardening

and trade when times are good and shift to food collection when the region is doing poorly.

2.3.1 Gardening

Subsistence gardens of maize, melon, and squash are the primary source of calories during the wet season. A family garden plot typically produces between 100 and 200 kilograms of ground maize in a good year, which is enough for some storage and continued use into the dry season. Twe villages are located near seasonal rivers with garden plots lining their banks. Men are typically responsible for clearing and fencing garden plots and may also help till the soil, but women are responsible for most garden work. The vast majority of women's time between November and April (assuming a year of good rain) is spent tending the garden, protecting crops from birds before harvesting, and grinding maize into flour. Technically, garden plots are considered women's property and are transferred from mother to daughter [25], but space along the river does not appear to be limited and young women and single men often start their own gardens.

2.3.2 Hunting and Gathering

Although some wild foods are only available during the rainy season, the Twe spend more time foraging in the dry season or during years with insufficient rains for gardening. The suite of wild foods is consistent with those listed in Malan's account of the Tjimba hunter-gatherer economy [7, 26]. Women collect most fruits, berries, and tubers, but there are some foraged items that are left for the men. *Tylosema esculentum* produces a large rhizome that requires tremendous effort to unearth, and because of this, it is considered a male responsibility. Men are also responsible for collecting the fruits of makalani palm *Hyphaene petersiana* and baobab *Adansonia digitata* trees that require throwing stones to knock them out of the branches.

In addition to direct subsistence, women's foraging regularly expands to cosmetic items used in both personal consumption and trade. This includes a wide variety of fragrant leaves, barks, and resins that are either added to skin ointments or smoked onto skin and clothing. The largest cosmetic industry is an alternative to the butter and fat that Himba women mix with red ochre to create their iconic *otjize* skin application. Twe women achieve the same look by processing the seeds of inedible *Ximenia* berries into an oil that is then mixed with ochre. In addition to personal use, the Twe also sell this mixture to Himba women living in nearby market-oriented sedentary villages. These women do not have easy access to animal products and instead purchase commercial petroleum jelly or the less expensive Twe alternative. Processing of "Twe *otjize*" occupies a significant portion of women's time

in the dry season (see Figure 2.1).

Hunting was once the core of Twe men's identity [1]. Today, men still occasionally take kudu (*Tragelaphus strepsiceros*) and other large game but are mostly limited to small game like rock hyrax (*Procavia capensis*) and duiker (*Cephalophinae*). This is due in part to strict conservancy regulations, but owes more to declining game populations. The South African government's forced relocation of pastoralists away from White-owned ranches and into the northern Kunene Region in 1929-1931, followed by the introduction of artificial bore holes and veterinary services, has dramatically increased the livestock density in the Lower Kunene Region [27, 28]. The resulting overgrazing led to a significant decline in large game [29]. Twe informants also note how traditional methods of setting traps at water-holes using snares, pitfalls, and poison are impossible when there is the risk of capturing a neighbor's livestock. This is a form of competition between hunters and pastoralists that has been reported in other societies [30].

In lieu of hunting, men identify honey collection as their key foraging pursuit. Men follow bees in flight and track small secretions left on stones to find hives in the same manner recorded among the Damara [31]. After extracting a bucket of combs from the hive, men plug the hole with a rock and hide their trail, hoping to return to harvest again once the hive has recovered. The Himba occasionally manage hives in a similar fashion, but are also more likely to simply burn down trees, forcing the bees to colonize a new hive in an unknown location. Twe men also tap makalani palm trees to extract a sweet beverage, which can be fermented to create a mildly alcoholic palm wine. Each tree produces approximately 10 liters of palm wine and provides a major source of calories, especially among the Twe living near the Kunene River where palm trees are abundant (see Appendix B).

2.3.3 Crafting and Spiritual Healing

The Twe are locally renowned for their iron work. They make small furnaces using the wood from *Ptaeroxylon obliquum* trees and sometimes a traditional bellows made from leather and *Albizia tanganyicensis* wood to prepare scrap iron (see Appendix B). The most common industry is small iron beads that are threaded together to create jewelry (see Figure 2.2). A man working from dawn to dusk can make enough iron beads to trade for 4,000 to 5,000 calories of maize meal. Men also shape iron into arrow heads, spear heads, and knives, and carve wood into milk buckets, bows, and arrow shafts. One man sources giraffe pelts from south of the region and has established himself as the premier cobbler of giraffe sandals, which are a fashionable status symbol among the Himba. Women weave palm leaves into baskets, and are also known for their distinctive clay pottery. Most crafting is

Figure 2.1. Twe cosmetic oil

The picture on the left shows a woman crushing *Ximenia* berries to remove the pip. The picture on the right shows a man holding the finished product ready to bring to market for sale.

done sitting under a tree during midday when it is too hot to be out in the sun doing other tasks. Crafted items are taken to Himba settlements whenever a significant quantity has been stockpiled, and are traded in exchange for maize meal or goats.

In addition to crafting, some Twe are able to earn an additional income by selling their services as spiritual healers. Healers use herbal medicines, dancing, and incantation to treat their patients. Patients travel from as far as the Ovambolands in northeastern Namibia to seek the services of a renowned healer, which is a status both men and women can achieve. Spiritual healing may be one area where the Twe actually profit from their outsider status. Bantus often accuse the Twe of using malevolent sorcery, which creates a reputation that becomes profitable when there is a need for spiritual services. Witchcraft is not an option for most Twe individuals, nor do the Twe have a tribal monopoly on spiritual services in the region. However, spirit healing is a potentially lucrative profession. In fact, the wealthiest Twe man in Namibia is a famous witch-doctor living away from the rest of the community on the outskirts of the major town in the region.

2.3.4 Government Provisioning

The Namibian government began a program to provide aid to the Twe and Tjimba tribes after a devastating drought in 2007. The program technically provides 10kg of maize meal per person each month; however, supplies are diluted by distribution to unregistered

Figure 2.2. Crafting of iron beads

Men clip off bits of wire scrap iron, bend it around the tip of a sharpened stick, and file it into the desired shape to create *mihanga* beads to fashion into anklets and other jewelry.

relatives coming from Angola. The Twe also benefit from a pension program that gives a monthly stipend of N$500 (enough to purchase about 25kg of maize meal) to all elderly people in the region. Not only do pensioners use the income to purchase food for their families, but the aggregation of Himbas collecting their pensions provides a great opportunity for Twe to sell crafts and foraged goods.

2.4 Tweaking Traditions

The Twe are fully acculturated into the traditions of their Bantu neighbors. Some Twe live on the border of predominantly Zemba or Kuvale regions and mimic the culture of those tribes, but most Twe follow the same cultural traditions as the Himba and Herero. The most immediately apparent example of this is the Twe women's aesthetic culture. Himba and Twe women both apply red ochre to their skin and hair and indicate their social position with the same styles of headwear and hair braiding [32]. However, men and children among the Twe do not follow Himba aesthetic traditions as closely. Young Twe bachelors rarely wear their hair in a ponytail and married Twe men rarely wear a turban; these indicators of social position are standard practice among the Himba. Children are often dressed according to Himba fashion, but some parents outfit their children in the traditional Twe style (see Appendix B). Beyond material culture, the Twe also follow the Himba and Herero in their

core cultural practices. This includes worship of ancestors at the holy fire, recognition of kin through both paternal and maternal lines of descent [33], and other specific details regarding expected practice and ritual performance. The adoption of these cultural packages means that the Twe hold ideals that have been shaped by the constraints of a pastoralist existence. The following section discusses the ways in which actual Twe behavior deviates from this professed culture and offers an interesting perspective on how these ideals conflict with an alternative way of life.

2.4.1 Resource Parity and Female Autonomy

Because few Twe control large herds of cattle, the relative difference in production between men and women is minimal. Men and women both work hard in their sex-specific tasks, and without the accumulation allowed by inheritance, men are unable to control considerably more resources than women. This puts women in a situation where marriage will not substantially improve caloric security, which increases women's relative bargaining position in marital decisions. This is best illustrated by comparing the Twe and their pastoralist neighbors with respect to women's role in determining who they marry, when they marry, and where they live during that marriage.

One way in which Twe women express increased autonomy relative to women in neighboring tribes is their ability to control who they marry. Traditional Herero and Himba marriages are either arranged by the parents of both spouses or more commonly today between a man and his prospective father-in-law [34]. This could mean an arrangement to marry a prepubescent girl once she comes of age, or a more immediate marriage to a young adult woman. This is still the modal form of marriage throughout the Lower Kunene Region, but there are alternative cases in which a man and woman first develop a relationship and then later ask their parents for permission to marry. Scelza's work among the Himba labels these "love match" marriages [35]. Love matches only account for (23%) of Himba marriages, but are the most likely route among the Twe (57%). Furthermore, even arranged marriages among the Twe are predominantly between adults. Only 16% of Twe marriages are arranged before the wife reaches menarche. Attempted arrangements are more common, but girls are often uninterested in the union once they come of age and parents rarely pressure them to go through with the marriage. Twe women also rarely become second wives, even though polygyny is common among the Twe's neighbors. Less than 15% of men have more than one wife. None of the polygynous men in my data are married to a woman under the age of 30, and their wives' average age is greater than 50.

Parents' inability to directly profit from marrying off their daughters may help explain

why young Twe women are often able to decide who they marry. Among the Herero and Himba, bridegrooms give bride wealth (*otjitunya*) typically consisting of several cows. This represents a relatively small portion of many Herero and Himba herds; however, cows are prohibitively costly for most Twe. Cattle are given as bride wealth in only 18% of Twe marriages and in most of those cases, it is only a single cow. Smaller gifts such as blankets, sacks of maize meal, or buckets of honey are more common. These exchanges likely do little to compensate for the production lost when a daughter marries and moves into her husband's household.

An interesting pattern that likely falls out of women asserting more control over their marriage decision is the surprisingly late age of first marriage and low overall rates of marriage among the Twe. Most women are not married by age 25 and women's rate of marriage never surpasses 70% even at its peak around 30 years old. Men follow a similar pattern but peak later and higher (see Figure 2.3). Because of this delayed marriage, 56% of young women (younger than 26 years old) with children are still unmarried. Interestingly, these women are more likely to become married once they have daughters old enough to help them look after younger children and manage household chores (see Chapter 4). This is a time when moving away from their mothers may be less costly (see discussion of this in Chapters 3 and 4). It should be noted that not all of these women are without the assistance of their children's fathers. Unmarried couples may live together in the woman's familial household and then later marry and move into a separate household.

2.4.2 "Double-descent"

The Twe nominally recognize the same double-descent system seen among other Herero-speaking peoples [36, 33, 37]. A child is born into the matriclan (*eanda* sing. *omaanda* plur.) of its mother and the patriclan (*oruzo* sing. *otuzo* plur.) of its father, or if born out of wedlock, takes the patriclan of its maternal grandfather. Matriclan membership is lifelong for both men and women, while a woman takes her husband's patriclan after marriage [38]. These two clan systems play a distinct and complementary role in organizing social relations within and between the Herero-speaking groups of the region, but it is clear that the importance of patrilineal descent is muted among the Twe.

The matrilineage forms a person's network of extended family. All members of a matriclan are considered family, and because matriclans cross tribal boundaries, they facilitate relationships broadly throughout the region. Even though the Twe are generally considered an outsider group, they still share the same set of matriclans seen among the Himba, Zemba, Ndimba, and Hakaona. Bollig argues that this arrangement helps mitigate the stigma of

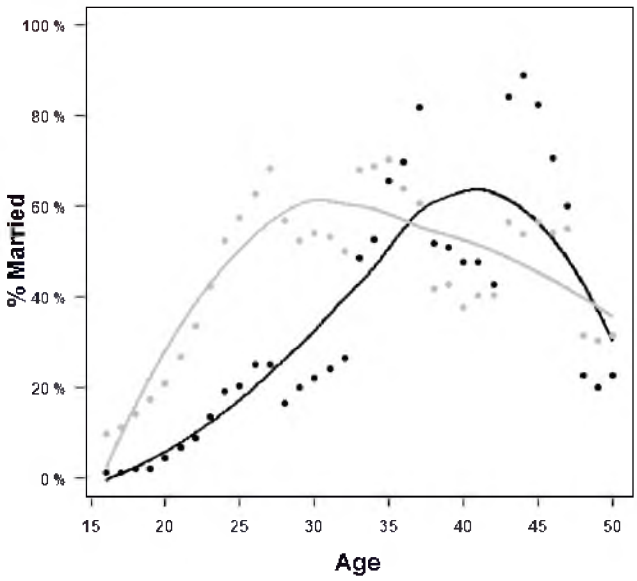

Figure 2.3. Age-specific marriage rates

The black points and lowess line show the average rate of marriage for men by age from 16 to 50. The grey points and line show the same for women. The value for each year is calculated using the surrounding 2.5 years.

being "Twa" at least among some neighbors, and is thus important for acquiring clients for trade [11]. Matriclans are the primary route for the inheritance of material wealth [25]; however, matriclan membership is considered extremely important even among the many Twe who have no prospects of seeing an inheritance.

While all Twe know their matriclan, 21% either claim they have no patriclan or cannot recall which they belong to. This seeming lack of interest in the patriclan is a stark contrast to neighboring Himba and Herero for whom the patriclan is an essential level of social organization [38]. Furthermore, even among those Twe who named a patriclan, there are clear signs of recent adoption of the patriclan system. The modal Twe patriclan is *otjirumbarumba* (36%), which the Twe use interchangeably with the better-known Himba patriclan of *otjihinaruzo*. *Otjihinaruzo* literally translates to "has no patriclan" and is distinct from all other patriclans in that it has no origin story and does not impose any traditional prohibitions [37]. The relatively weak association with the patriclan among the Twe is consistent with the strong link between cattle ownership and patriliny observed across African societies [39].

Patriclans and their subsidiary patrilineages (*okuruwo*) assert their power within res-

idential units. Access to grazing lands, water sources, and political authority within a territory are all transferred through the patriline among the Himba [25]. The eldest male in the patrilineage is considered the "keeper of the fire" and he acts as the priest for all households that are affiliated with that particular *okuruwo*. This system is dependent on families aggregating into patrilineally linked villages and this may be where the importance of patrilineal descent breaks down among the Twe.

The Twe live in "households" (*ozonganda*) of approximately two to five adults nested in "villages" (*ovirongo*) of approximately 10 to 40 adults, nested in "communities" of several villages (see Figure 2.4). The household level is the family unit that eats together and shares a garden and a communal living space. If the family owns livestock, the household is fenced in like a traditional Himba kraal, but otherwise, huts are simply clustered tightly in space. The village level is composed of several regularly interacting households. The village operates as a political unit, and individuals from different households often socialize and cooperate in subsistence tasks during the day. The community level unifies contiguous groups of villages. Twe households often relocate within the community territory throughout the year, aggregating into villages along the river in the wet season and dispersing in the dry season.

The traditional Himba model calls for villages composed of patrilineally linked nuclear family households. However, Twe residence often fails to conform to this ideal. For example, four of the six heads of household in the Otjitanga Valley's largest traditional village are matrilineally related, and a fifth is married to the sister of one of the matrilineally linked households. Only two of these six households share the same *okuruwo* as father and son. Even at the community level, the headmen of the two largest villages in the valley are linked through their marriage to sisters.

The patrilineal village requires strict patrilocal residence with brothers staying together for life and women moving out and marrying in. Less than 40% of men are ultimately able to bring their wives to stay in their familial villages. As noted above, marriage often results in a couple moving out of the wife's household, especially at older ages. However, in many cases, this only means establishing a separate household within that same village. In this sense, it appears that women's ability to assert more control over decisions about residence within the marriage may contribute to the decreased importance of patrilineal institutions. This pattern supports the "main sequence" theory of kinship, which argues that subsistence shapes decent-based institutions via residence, at least as it applies to pastoralist Africa [40, 41, 42]. Without cattle-wealth as a bargaining piece, related Twe men are unable to

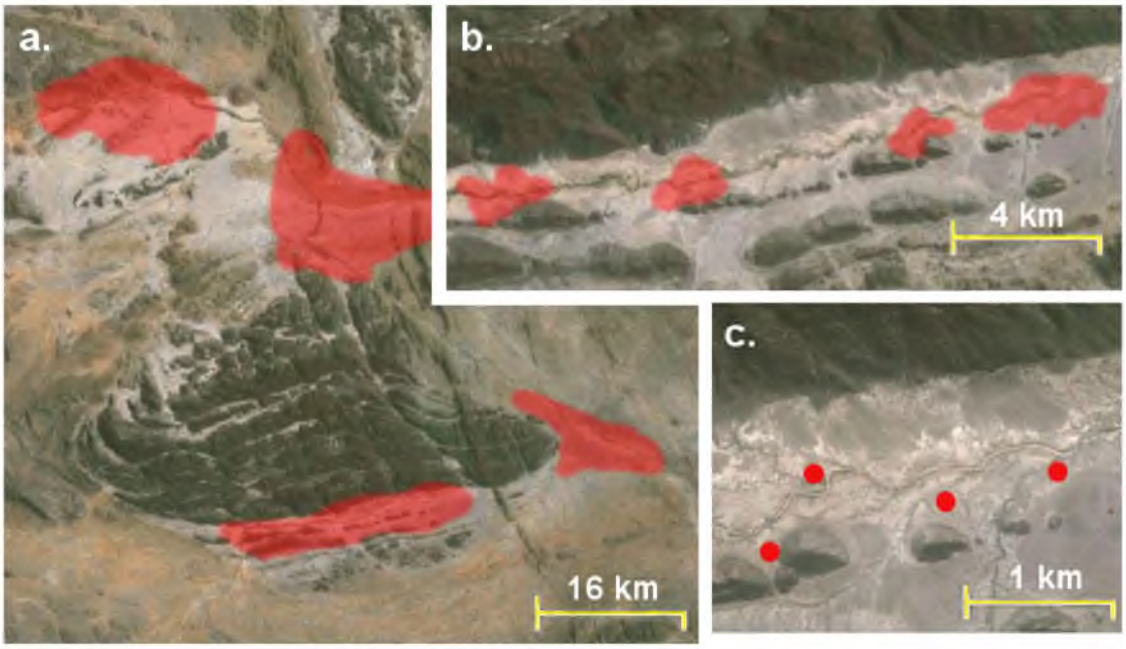

Figure 2.4. Communities, villages, and households

a) Maps the distribution of Twe communities in a subset of the Twe homeland. b) Zooms in to show the distribution of villages within a single community. c) Zooms in to show the distribution of households within a single village

consistently localize and this stunts the development of patrilinial institutions relative to their wealthier Himba neighbors.

2.5 Conclusion

The Twe are a population that has received limited attention from ethnographic researchers working in Namibia and Angola. With this paper, I hope to distinguish the Twe from the general and derogatory "Twa" label, and establish them as the cohesive ethnic group that they clearly are. In doing so, I attempt to pull together what little is known about their history and document their current way of life.

The Twe are locally recognized as an ethnic out-group, but future work is needed to identify where they fall in the history of the region, and even whether or not this classification is more than a recent phenomenon. The social costs of this position have placed the Twe in marginalized land for cattle grazing, which is exacerbated by further restrictions within that territory. In response, the Twe have moved to a diverse set of subsistence practices that allow them to survive in their harsh environment by shifting between activities and catering to the trade demands of their wealthier neighbors. Despite living a life that is not dependent on livestock, the Twe still observe the cultural traditions

of local pastoralists, but in some cases, they break from these ideals in ways that better suit the situation they face. With a minimal wealth disparity between men and women, women are able to exert more decision-making power and this in turn affects patterns within marriage, residence, and the role of different kinship institutions.

Accurately describing the Twe is important in its own right, but documenting the ways in which they subsist and organize their society without heavy reliance on cattle-wealth also has broader implications. Understanding the Twe may also help illuminate the lives of similarly impoverished and understudied local groups like the Tjimba and Koroka, as well as the many individuals and subgroups among the wealthier tribes who themselves do not achieve the pastoralist ideal. Additionally, there have been many periods of drought and disease in the history of the region that would have forced much of the larger population to face the same challenges that the Twe currently deal with. The way the Twe manage these circumstances today may inform expectations for how people throughout the region responded during those times.

CHAPTER 3

CHILDCARE DYNAMICS AND WOMEN'S RESIDENTIAL AUTONOMY

3.1 Introduction

Females among our closest primate relatives disperse from their natal group after reaching reproductive maturity [43, 44, 45]. This is also the case in many human societies [46], but is far from a universal pattern and only describes a minority of documented foragers [47, 48]. Instead, the modal pattern of postmarital residence among human foragers is multilocal, where both sexes may or may not disperse from their natal camp [49]. These flexible systems are complex and situation specific, but often women remain in their family's household initially, then later move away, possibly into the familial household of their husbands [48]. This general pattern is supported by informants in a wide variety of forager societies [50, 51, 48, 52], but has only been assessed with quantitative data in a minority of cases (see [53] for the Aché and Ju/hoansi and [54] for the Hadza). Marlowe finds that 25% of the forager groups in the Standard Cross Cultural Sample fit this pattern [48, 55]; however, the real prevalence may be even higher since the ethnographic data rarely gives the level of detail needed to identify age-based trends in multilocal residence. In this paper, I use a computer simulation to demonstrate how this pattern could follow from the dynamics of childcare assistance within the natal camp over time.

Due to short interbirth intervals and long periods of childhood dependence, human mothers often find themselves simultaneously caring for multiple young children [56]. In order to meet this challenge, dependence on nonmaternal sources of care is an important feature of human life-history [57, 58]. Children require food, physical contact, transportation, washing, and constant attention to ensure they stay safe from harm. These needs are particularly acute in the first several years of life when mortality risk is at its peak [52]. Fathers often add support in the form or food provisioning and in some cases holding infants [59, 60], but are much less involved in other aspects of childcare. This may be due to the sexual division of labor that separates men from their children throughout much of the day [61]. This lack of direct childcare could explain why the loss of a father has little or no effect on child survival across many different societies [62]. Especially when food is widely shared throughout camp, the particular nature of paternal provisioning may be easily substituted

by alternative sources when necessary [63, 64, 65]. Rather than fathers, it is often mothers' female relatives who have the strongest impact on children's well-being [62]. A woman's mother and sisters help by directly caring for her children and cooperatively managing the balance between watching over children and accomplishing daily tasks [66, 67, 60, 68]. Since these sources of care are available to women living in their familial camp, but not to those who move to live with their husbands' family, childcare assistance may be one important incentive for women to stay home.

However, as early-born children age, those children also begin to play an important role in childcare assistance. Even children as young as 3 years old begin offering rudimentary childcare and by 6 may be regularly responsible for tasks like carrying and watching over their younger siblings [69, 70, 71, 72, 73]. The role of older siblings in childcare varies cross-culturally but in many places, sisters, and in at least one case, brothers, are responsible for more direct childcare than any source outside the mother [74]. This sibling care is linked to positive outcomes like decreased interbirth intervals, extended fertile period, increased rates of child survival, and increased leisure time for mothers [75, 76, 77, 78]. Sibling care is interesting with respect to residence because unlike a woman's mother and sisters, her children are tied to *her* rather than the familial household. This makes older children a source of childcare assistance that can be utilized even after moving away from home. This paper presents a computer simulation abstracted from the demographics and childcare decisions of a female kin-group across a 20-year generation. The findings demonstrate how the burden of childcare can shift away from aunts and grandmothers and onto the mother and older siblings over time, opening up the opportunity for women to move away from their familial household as they age.

3.2 Method

I use a computer simulation to investigate the dynamics of childcare in a group of cohabitating related individuals. The model assumes a household with a single postreproductive caregiver (G1), her two care-giving offspring (ego and G2), and their offspring that accrue throughout the duration of the simulation. The two second-generation care-givers start at age 20 and add new infants to the family with a 25% chance each year. Throughout the 25 simulation, the family distributes age-based care points in order to remove age-based need points. The simulation tracks the amount of care points that are allocated within the focal unit of ego and her offspring, as well as outside care points that come from G1 or G2 and her offspring. This distinction is essential because I am not interested in the total amount

of care distributed, but rather the amount of care that is tied to the household.

3.2.1 Care and Need

All actors are allocated a new set of "need" and "care" points each year of the simulation. These points represent the amount of care that an individual can give and receive. Need points start at 1 for a newborn offspring and decrease by 0.2 each year until falling to 0 at age 5. Care points start at 0.05 at age 6 and increase linearly up to 1 at age 25. These points represent actors' transition from care-receptacles to increasingly competent care-givers with age. Six may seem a remarkably early age to begin allocating care points, but very young children are stable sources of childcare assistance in many societies. In fact, young children may actually provide more direct childcare than older juveniles, either because with age comes more diverse economic responsibilities or possibly due to sexual conflict between older girls and their mothers [79, 80]. With this design, a care-giver of age 26 or older can fully manage one newborn infant alone, but any additional dependents will require assistance.

3.2.2 Distribution

Each year, care-givers distribute their care points among needy offspring in order to eliminate need points. This distribution is managed such that individuals take turns distributing care with the most interested and able care-givers acting first. All possible relationships between care-givers and recipients are ranked first by genealogical relatedness, then by the need of the recipient, and finally by the amount of care points available to the care-giver. Thus a 26 year old care-giver who has not yet provided any care (peak care points of 1) with a newborn offspring who has not received any care (peak need points of 1 and relatedness of 0.5) will always be the first to act. In the case of multiple equal claimants, the order is randomly determined. The care-giver in the top-ranked pairing subtracts the smaller value of either her total care points or the total need points of the recipient. This value is then subtracted from the recipient's need points. After these points have been allocated, the complete list of relationships is reranked using the updated information and points are again distributed within the new top-ranked pair. This process is repeated until there are no remaining care-giving opportunities.

3.2.3 Recording Care Transfers

The focus of this simulation is identifying how the source of care changes over time. In particular, the model discriminates between care that is distributed among ego and

her offspring, and care distributed outside that focal unit. This discrimination is essential because care that stays within the focal unit is assumed to be residence independent, while the sources of care outside the focal unit are only available in the natal household. During each distribution phase, the simulation records the amount of care that is distributed within the unit and the amount distributed outside the unit. It should be noted that not only is care from G1 and G2 to ego's offspring viewed as a unique benefit to residing in the household, but also the care ego directs towards G2's offspring since that represents inclusive fitness benefits that could not be accrued living outside the household (see Figure 3.1).

3.3 Results

The simulation finds that ego's care-based incentives unique to the natal household decrease with age (see Figure 3.2). The amount of outside care initially rises along with the likelihood of being burdened with a second dependent offspring, then decreases as earlier-born offspring reach an age where they can begin accepting some of the childcare responsibilities. This shift happens because these older children's care crowds-out care coming from sources outside the focal unit. Additionally, since both ego and her G2 sister are simultaneously experiencing a similar demographic shift, the opportunities to benefit

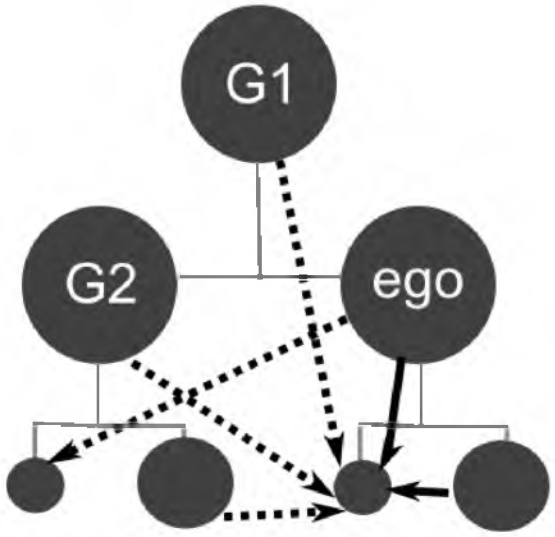

Figure 3.1. Care transfer diagram

Circles represent actors in the simulation and bars represent the kinship links between them. The larger circles in the third generation represent care-giving offspring. Solid lines show residence-independent caring relationships, while dotted lines show caring relationships unique to the natal household. Note, the number of offspring starts at 0 and grows throughout the simulation.

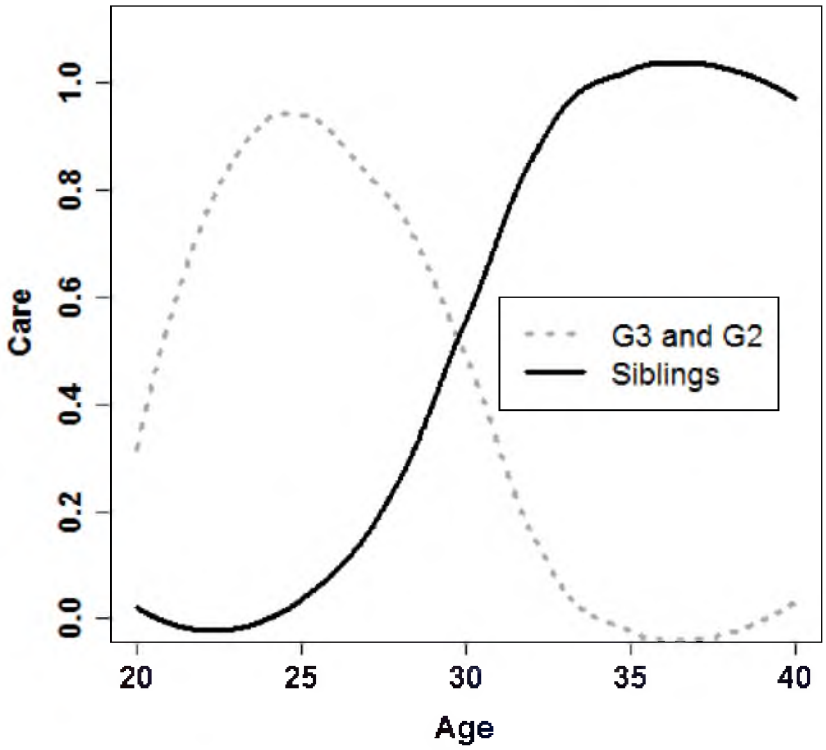

Figure 3.2. Model output: Source of care with age 1

Plot compares the mean amount of care coming from siblings to care coming from the G3 grandmother and G2 aunt and her offspring across the 20-year generation.

through providing care to nonoffspring also decreases from ego's perspective.

While there is a clear downward trend with age across the simulations, there is considerable variation within a given simulation (see Figure 3.3). Due to the stochastic composition of kin groups resulting from the random reproductive rate of ego and G2, individuals may find themselves with limited care-based incentive in one year then significant incentive in the next.

Increasing the rate of reproduction or including additional sisters both slightly decrease the initial incentive to remain home, but retain the same qualitative pattern seen above. Placing the transition from needy to care-giving at an older age retains the eventual decrease, but delays it until later in the generation. Adding the possibility of producing noncaring offspring (boys) has no significant effect on the pattern. The assumption of linear increase in care with age may be inconsistent with the human case. Research in both humans and nonhuman primates shows that mothers' ability to care improves dramatically

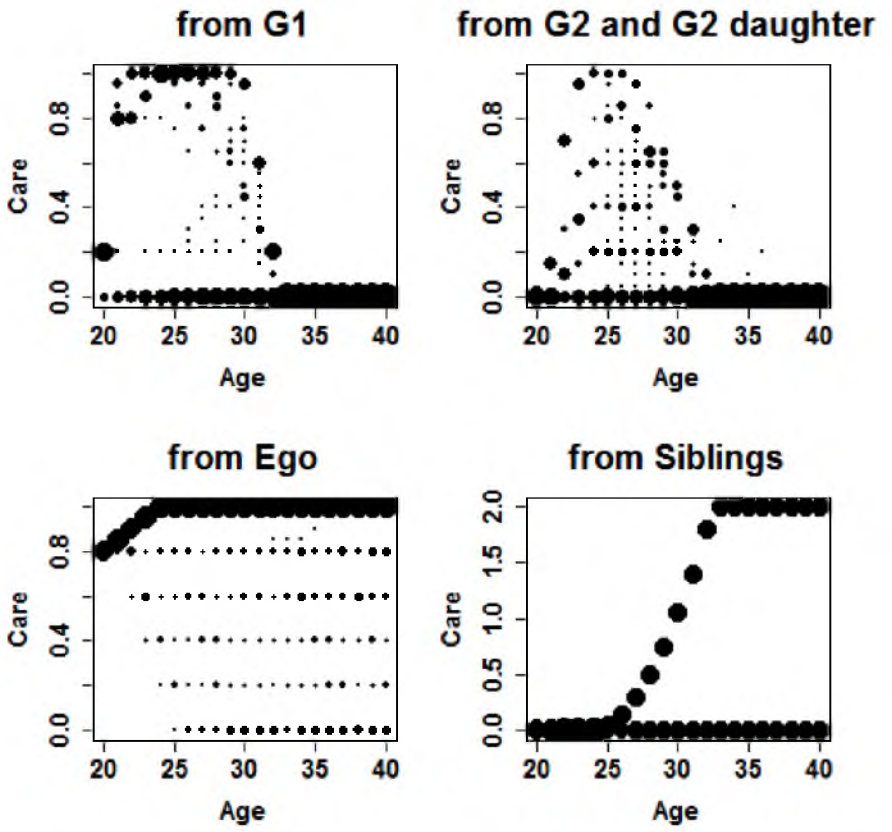

Figure 3.3. Model output: Source of care with age 2

Plots show the care given by different relative classes at each age across 100 simulated generations. The level of clustering across simulations is indicated by the size of the points.

after their first child [81, p. 63]. If we adjust the simulation to fit this pattern, the amount of outside care received in the early 20s increases to flatten out the initial bump in the curve without impacting the later age decline (see Appendix C).

3.4 Discussion

The results of this simulation show how in a cooperative care system where both secondary kin and siblings direct childcare assistance towards children, there are decreasing incentives to the natal camp as early-born children become reliable sources of care. This demonstrates how childcare assistance may offer a powerful incentive towards philopatry early in a woman's reproductive career that tapers off over time. Assuming some constant pressure to move away from home such as resource competition or the conflicting interests of husbands, the diminishing lure of childcare assistance helps explain the common forager residence pattern of initially living with the wife's family ("uxorilocality") followed by a

shift to the husband's family or a new household ("virilocality" or "neolocality").

Wood and Marlowe recently proposed an alternative model to explain this pattern that focuses on how women can expect more paternal investment while living in their husband's camp later in their reproductive careers than when they only have one or two children [82]. Both the Wood and Marlowe model and the model proposed in this paper predict that women should be more open to virilocal residence when they have more children. The factors in these models do not conflict in any way, and may both help explain the pattern of early uxorilocality and late virilocality. However, the model put forward in this paper also helps explain cases where couples shift to a neolocal residence later in life, as well as cases where even unmarried women move away from home as they age.

It is important to note that while I discuss this pattern of uxorilocal to virilocal residence, the modal pattern among foragers is more general flexibility with many residence shifts throughout life. Additionally, even among groups characterized by an uxorilocal to virilocal transition, this description disguises the tremendous flexibility of actual residence decisions. Individuals among the Hadza, !Kung, and many other forager groups regularly shift residence throughout their lives. Uxorilocal to virilocal merely captures the population-level trend in observed residence across the lifetime of individuals. This perspective of a general trend with underlying residence stochasticity is consistent with another finding in our simulation. Despite the expected decrease in household incentive with age, the incentive for ego to live at home varied widely within individual simulations at a given point in time. This was a function of random variance in the rates of reproduction in the simulation, but the availability of childcare assistance in real life is likely to be even more variable. The death of important sources of care, infant mortality, variable fertility, residence decisions of female relatives, and other factors would put individual women in situations where the incentives of childcare assistance in their familial camp are not consistent with simple age-based expectations. This variable nature of childcare assistance as an incentive to philopatry allows for a system of facultative residence shifting at a much higher rate than implied by the mean decrease in expected childcare assistance with age.

The variable and transient nature of childcare assistance as an incentive towards female philopatry has implications for the development of bilateral relationships between in-laws [83]. Chapais argues a central role for both sexes forming affinal relationships in the story of human evolution [84]. Even in species characterized by sex-determinant dispersal patterns, individuals deviate from expectations when it is advantageous [85]. Stable residence incentives are conducive to social systems with simple dispersal rules. In contrast, when

the incentives to dispersal and philopatry are expected to change over time, as I show with childcare assistance, more complex patterns may arise. While females are expected to have a strong incentive to remain home early in life, males may see an advantage to retaining contact with their natal household even after dispersing to find a mate. Not only is it likely that he can bring his mate to live with his kin later in life, but the dynamics of childcare in her household may allow at least a temporary visit to his familial household much sooner. Initially dispersing males returning home with bonded females results in both members of a pair-bond being integrated into the household of their affines, allowing for bilateral affinity. Chapais argues that the transition from female dispersal to bilateral affinity was the result of reciprocal exogamy and strong brother-sister bonds. However, if a tendency towards early female philopatry resulted from the rising importance of childcare assistance, the nature of this particular incentive may offer an alternative explanation for the advent of bilateral affinity and whatever other traits cascade from that social adaptation.

CHAPTER 4

HOME IS WHERE THE HELP IS: *HOW CHILDCARE ASSISTANCE SHAPES TWE WOMEN'S RESIDENCE*

4.1 Introduction

People in most small-scale societies must look outside of their residence group for viable marriage partners. This practice of exogamy leads to at least one spouse moving away from his or her family following marriage. In a world where family is the central source of economic, social, and political relationships, the decision of which spouse leaves home has powerful implications. One such implication is that women lose access to the childcare assistance provided by their mothers. This paper looks at marital residence decisions from the perspective of women seeking childcare assistance, and uses the incentive of extra-maternal care to help explain residence among the Twe of northwestern Namibia.

Since the inception of the field, anthropologists have been interested in understanding the variable ways in which people manage the problem of postmarital residence [86, 87]. Most of this research uses group-level phenomena such as subsistence focus, warfare, and population crashes to explain variation in postmarital residence cross-culturally [88, 42, 89, 90, 91, 92, 93, 94]. However, recent analyses demonstrate considerable variability in the actual patterns of residence within populations in addition to the variability that exists cross-culturally. This is especially true for simple hunter-gatherers and other groups with limited heritable wealth [95, 96, 47, 48, 49, 97]. Not only do different couples often come to different residence decisions in these societies, but each couple is likely to adopt a variety of strategies over time. Many previous approaches to understanding residence are only applicable to differences between groups, and thus new approaches are needed to help understand the patterning of groups with "flexible" residence.

There are undoubtedly many different factors that shape individual residence decisions. This paper investigates the role of women seeking access to childcare assistance as one potentially influential factor. Cross-culturally, the majority of extra-maternal childcare comes from a woman's close female relatives [98, 68, 99, 100, 101]. This is important with respect to residence because a woman's mother and sisters are unavailable if she moves

to live with her husband's family. Cohabitating with these key relatives, especially the postfertile maternal grandmother, is associated with increased child survival and is a stated preference of many women among the Twe and other populations [62, 102, 103].

Blurton-Jones investigated the relationship between residence and childcare among the Hadza from the perspective of postfertile women optimizing investment in their grandchildren [54]. Hadza grandmothers were both more likely to live with daughters than sons and more likely to live with daughters who were nursing infants than those who were not. Scelza finds that married women among the strictly virilocal Himba use temporary visits home to access female relatives, especially during pregnancy [35]. This pattern shows that even in situations where women are unable to maintain regular contact with their families, access to childcare influences residence during peak periods of need. The Twe live near the Himba but practice a more flexible pattern of residence (Chapter 2). This paper investigates whether Twe women use their mothers as a source of everyday childcare assistance when their residence decisions are not overwhelmed by cultural proscription or dependence on male-controlled resources.

The lure of potential childcare assistance creates a clear incentive for women to remain home. However, not all close female relatives are tied to a woman's natal camp. Even as young as 6 or 7 years old, prefertile girls begin directing childcare towards their younger siblings [69, 70, 71, 72, 73]. Behavioral observations find that a child's older sisters are responsible for more direct care than any relative-class other than the mother herself in many societies [74]. This intrasibling care is associated with a collection of fitness-enhancing maternal effects, including decreased interbirth intervals, extended fertile period, increased rates of child survival, and increased leisure time [75, 76, 77, 78]. With respect to residence, babysitting daughters are interesting because they provide a source of care that a woman can take with her when she moves. This potentially frees women to respond to other residence incentives without sacrificing access to a secondary source of childcare. In addition to looking at whether women stay home when they need childcare assistance, this paper also investigates the hypothesis that women are more likely to live away from home when they have daughters old enough to subsidize childcare in an alternative location.

4.2 Materials and Methods

4.2.1 Population

The Twe are a population of approximately 3,000 people living in the dry and mountainous region surrounding the Kunene River in northwestern Namibia and southwestern

Angola. Their material and ritual culture mirrors that of the well-studied Himba, but they are locally viewed as an outsider ethnic group [1, 7, 104]. The Twe practice a mixed subsistence that includes gardening, hunting and gathering, animal husbandry, and the sale of crafted and foraged goods [11]. Men and women appear to contribute relatively equally to subsistence, and because the Twe possess minimal heritable wealth, there is limited disparity between the two sexes (see Chapter 2).

The typical Twe household includes the nuclear family and some extended kin. Households often shift location between a rainy season camp near the family's garden and dry season camps in or near the mountains. Especially during the wet season, households cluster into villages along seasonal rivers, with households spaced within several kilometers of one another. Village populations typically range from 10 to 30 adults, while one recently established government camp with a school, clinic, and water-tower has 40 adults living nearby. This study includes 40 different households spread across 19 villages and looks at women's movement between these residences throughout their reproductive careers.

Most Twe women start their reproductive careers between ages 19 and 22. The average interbirth interval of Twe women is 3.4 years and approximately 12% of children die during infancy (child mortality data come from self-reports and is likely under-reported). I do not have the data to appropriately asses total fertility rates, but the average Twe woman between ages 45 and 55 has 4.2 living children.

Men occasionally promise their daughters to other men, but these marriages are not made official until the girl reaches menarche and these promised unions rarely come to fruition due to the young woman's objections. A man may also arrange to marry an adult woman through her father. These marriages account for about 43% of marriages, while the rest involve a man first successfully courting a woman then going to her father to ask permission. The Twe do not recognize any formal system of bride service. Bride wealth is culturally expected, but rarely exceeds small gifts like sacks of maize meal, blankets, and buckets of honey. Most Twe participants say that a woman is supposed to move away from her family and live with her husband following marriage. This is consistent with the Himba rule of virilocal residence.

4.2.2 Procedure

4.2.2.1 Observational scans

Children's maternal grandmothers and older sisters are reliable sources of childcare assistance in many populations. However, there remains considerable cross-cultural variability in the child-caring role of different relative classes [105, 106]. I used observational scans to

assess the childcare role of different relatives among the Twe [60]. These scans took place in a single village between December 2010 and February 2011. This particular village was chosen because it offered the largest aggregation of Twe people, with 20 to 30 individuals within easy walking distance at a given time. This allowed both the collection of a larger sample in shorter time as well as a greater variety of possible childcare interactions because a broader range of relatives were available.

Initial scans were made each hour between 7 in the morning and 7 in the evening by walking an approximately 1 kilometer circuit through the village and recording all instances of someone holding a child under the age of 3, then reversing the route taken on the next scan. Participants began tending their gardens in late January. This stretched the camp boundaries and increased the route to more than 2 kilometers, which was too large an area to reasonably cover on an hourly basis. Camp scans during these final 2 weeks were conducted every 2 hours.

4.2.2.2 Residence history interviews

In order to assess the relationship between access to childcare and women's residence decisions, I used interviews to identify current and historical residence locations of women and their relatives. I interviewed 176 participants about contemporary residence in years 2010 and 2012 and historical residence during 1990, 2001, and 2006. The 3 earlier years were chosen because each had some salient event that made it easier to accurately recall. I also collected historical residence data from 1974 and 1983, but do not include those years in these analyses because reports were less reliable between participants and the precision of children's age estimates become considerably noisier that far back in time. I asked participants where they lived in each year, and then using previously collected genealogies asked where each of their parents, siblings, children, grandparents, spouses, spouses' primary relatives, aunts, and uncles lived during that time. Many Twe stay in multiple different locations within a given year but recognize a single location as their "home," which is what I use in these analyses. Seasonal residence shifts are typically made as a household unit, meaning that the available relatives remain static even if actual location changes. That said, individuals do travel away from the household within a given year for a variety of reasons, which makes the actual access to kin more complex than what is captured in these data.

4.2.3 Analyses

The data were analyzed using logistic regression models and data visualization techniques to test assumptions of normality. I conducted all data analysis using R 2.15.1 statistical software [107].

4.3 Results

4.3.1 Do Twe grandmothers and sisters provide childcare?

Mothers, older sisters, maternal aunts, maternal grandmothers, and female cousins in the maternal line were the relative classes most often observed holding young children. After adjusting for the number of individuals in each relative class in camp during an instance of holding, mothers, older sisters, and the maternal grandmother stand out as the most active carers (see Table 4.1). After mothers, older sisters have the highest "holding ratio" of all relative classes, being the individual holding a young child in 15 cases out of 80 opportunities. There were 51 cases of a maternal grandmother being available during a holding event and in 7 of those cases, she was the one holding the child. The next highest ratio was maternal female cousins who held a young child in 9% of opportunities. The sample size for these observations is quite small (28 days and 407 caring events) and limited to a single camp, but they support the assumption that the mother, maternal grandmother, and older sisters are the key sources of direct childcare among the Twe. This pattern is also consistent with women's self-reports of who they can expect to help take care of their children.

4.3.2 Does women's residence map onto childcare assistance?

Analyses use logistic regression with the dependent variable set as whether or not a woman lives with her mother. The dataset includes 86 unique women under the age of 45

Table 4.1. Who cares?

Relationship	*Holder*	*Available*	*Percentage*
Mother	292	398	73%
Older sister	15	80	18.8%
Mat. Grandmother	7	51	13.7%
Mat. Cousin (f)	8	90	8.9%
Father	8	124	6.5%
Pat. Aunt	1	16	6.2%
Mat. Aunt	10	320	3.1%

Includes all relative classes observed holding a young child in at least 1% of opportunities. 'Mat.' and 'Pat.' are used to discriminate between maternal and paternal relatives.

with at least one child and a living mother. These women account for 198 observations across the 4 years of residence data. Because the data-set includes multiple observations of the same women, it is important to account for potential data dependency issues. Each woman likely possesses different underlying characteristics that relate to childcare and residence in ways that are not captured in the data. In order to address this issue, I use linear mixed-effect models (LMEMs, function lme4 package [108]) that include by-participant random effects. Each LMEM includes by-participant random intercepts and random slopes for all critical variables when possible. This approach of using the maximal random effect structure minimizes Type I error [109, 110]. However, the median participant was only observed twice. This constrains model complexity and forces the omission of some random slopes which ideally should be included in the models.

Model 1 investigates whether women are more likely to live with their mother when they have young children. The model includes the number of children younger than 3 a woman has as a lone independent variable. Model 1 and all subsequent models omit by-participant random slopes for the "young children" variable because its inclusion makes the model too complex given the limited observations for each participant. This problem is seen in a weakened AIC score and deterministic negative correlation between the random slope and intercept. The fixed-effect for the "young children" variable is a significant predictor of women's coresidence with their mothers (see Table 4.2). Seventy-one percent of women with at least one young child live with their mother, while only 55% of women without a young child live with their mother.

The second model retains the "young children" variable but also looks at whether daughters old enough to take on a babysitting role, but still too young to have started their own reproductive career (age 6 to 15), allow women to move away from home. This model also includes a by-participant random slope effect for the 'babysitters' variable. Model

Table 4.2. When do women live with their mothers?

IV	*Model 1*		*Model 2*		*Model 3*		*Model 4*	
	B	*SE B*	*B*	*SE B*	*B*	*SE B*	*B*	*SE B*
Young children	**1.03**	**0.32**	**1.06**	**0.37**	**0.88**	**0.38**	**1.29**	**0.46**
Babysitters			**-1.75**	**0.48**	**-1.58**	**0.50**	**-1.58**	**0.54**
Age					-0.04	0.04	0.00	0.05
Married?							**-3.52**	**0.66**
AIC	**246.1**		**238.2**		239.4		**208.6**	
ICC	.55		.54		.42		.75	

Unstandardized betas and standard error of each coefficient in models 1, 2, 3, and 4. Bold values indicate statistical significance ($p < .05$). ICC calculation follows [111].

2 is a significant improvement over Model 1 (see Table 4.2). Both the "young children" and "babysitters" fixed-effects are significant predictors of women's coresidence with their mothers, but in opposite directions. There is also a by-participant random slope effect within the "babysitters" variable (variance = 4.67, *SD* = 2.16, Int. Corr = -0.34).

The next two models introduce important control variables. When the focal woman's age is entered as a lone independent variable, it is a significant negative predictor of women's coresidence with their mothers (*B* = -0.10, *SE B* = 0.03, p < .001). This makes age an important confound to control for because older women are more likely to both live away from home and have older daughters. However, the addition of age to Model 2 weakens overall performance and introduction of the age variable does not qualitatively change the relationship between young children, babysitters, and residence (see Table 4.2). Model 3 also finds a by-participant random slope effect for the "babysitters" variable (variance = 4.35, *SD* = 2.09, Int. Corr = -0.27).

Model 4 adds the focal woman's marital status as an additional control. Marriage is an important control because 40% of women in the sample are not married and there is a clear relationship between marriage and women's coresidence with their mothers. Seventy-three percent of unmarried women live with their mother compared to 28% of married women (see Figure 4.1). The addition of the marriage variable significantly improves model performance but does not qualitatively change the influence of young children and babysitters (see Table 4.2). Model 4 also continues to find a by-participant random slope effect within the "babysitters" variable (variance = 3.96, *SD* = 2, Int. Corr = -0.45). Finally, after including marital status, the relationship between age and women's residence with their mothers has been completely explained by the other variables in the model (see Figure 4.2).

One possible explanation for why offspring composition continues to explain residence beyond the powerful effect of marriage is that young women without babysitting daughters are less likely to be married (see Model 5 in Table 4.3 and Figure 4.3). This relationship is not simply a function of married women having more children, as the effect remains even after controlling for the total number of children a woman has (see Model 6 in Table 4.3). Models 5 and 6 also included only by-participant random slopes for the "babysitters" variable because more complex models failed to converge (Model 5: variance = 4.05, *SD* = 2.01, Int. Corr = -0.93; Model 6: variance = 4.07, *SD* = 2.02, Int. Corr = -0.91).

In order to test whether the babysitter effect actually captures something unique to girls in that age-group, I replaced the babysitter variable in models 2, 3, and 4 with one representing the number of boys a woman has in that same 7 to 15 years old age range. The

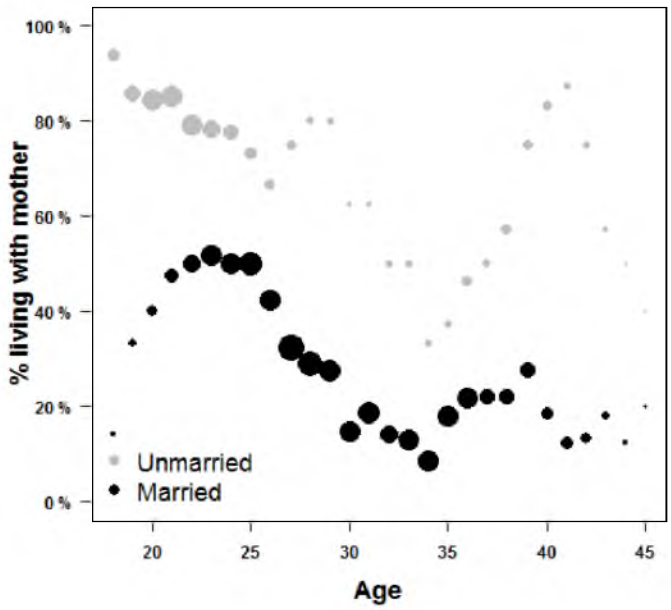

Figure 4.1. Observed rates of residence with mother

The above plot gives the observed rate of women's coresidence with their mothers at each age + or − 2 years. The size of points indicates the relative size of sample at each age.

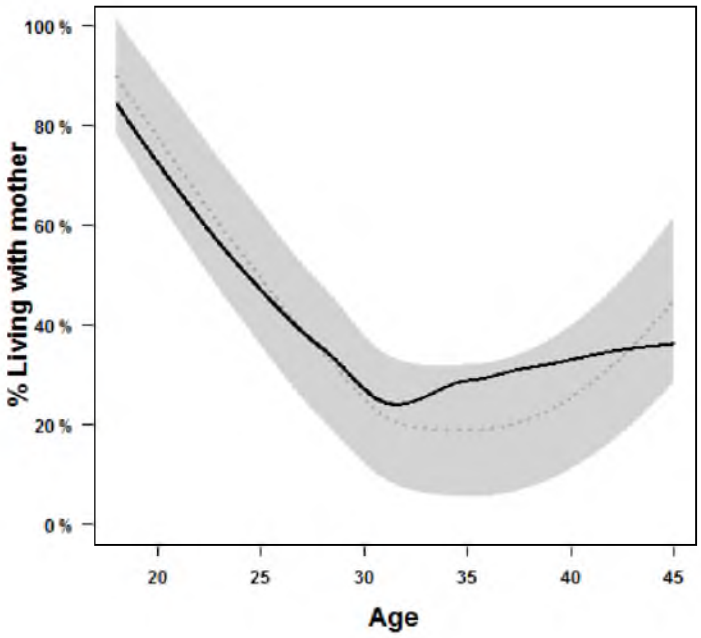

Figure 4.2. Predicted probability of living with mother across ages

The solid black line gives the observed percent of Twe women living with their mothers at each age from 18 to 45. The dotted gray line is the predicted probability that a woman lives with her mother at each age using Model 3 (see Table 4.2) and the age-specific means of young children, babysitters, and being married. The light gray shaded area gives that confidence interval around that predicted probability.

Table 4.3. Babysitters and marriage

IV	*Model 5*		*Model 6*	
	B	*SE B*	*B*	*SE B*
Babysitters	**4.82**	**2.40**	**4.81**	**2.45**
Age	**0.17**	**0.05**	**0.15**	**0.06**
Babysitters X Age	**-0.15**	**0.07**	**-0.15**	**0.07**
Total children			0.09	0.17
AIC	**261.9**		263.6	
ICC	.89		.89	

Unstandardized betas and standard error of each coefficient in models 5 and 6. Bold values indicate statistical significance ($p < .05$). ICC calculation follows [111].

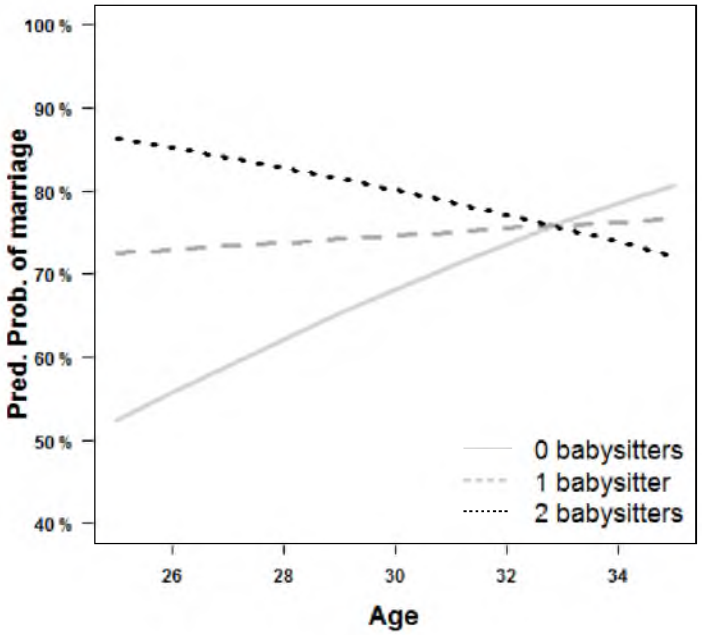

Figure 4.3. Predicted probability of living with mother

Model 5 predicted probability plot for ages 25 to 35 for women with 0, 1, or 2 babysitters.

number of older boys a woman has is only a significant predictor in the modified Model 2, and this effect is diminished after reintroducing the babysitter variable (B = -0.27, $SE\ B$ = 0.23, p = .23) showing that the impact of older boys is likely a function of their covariance with older girls.

Since the negative relationship between having a babysitter and women living near their mothers is assumed to be a function of decreased dependency on childcare assistance coming

from the maternal grandmother, we should expect the effect to be less pronounced when women do not have young children. The final model adds an interaction effect between the young children and babysitters variables along with marital status as a control. The interaction term in this model is in the expected direction but is not a significant predictor of women's residence (B = -0.92, $SE\ B$ = 1.20, p = .44).

4.4 Discussion and Conclusions

Maternal grandmothers and older sisters are the most reliable sources of extra-maternal childcare among the Twe. This is consistent with other empirical work investigating childcare in traditional societies. Twe women are more likely to live with their mother when they have more young children and thus greater demand for childcare assistance. In addition, Twe women take advantage of the residence flexibility offered by babysitting daughters who are tied to them rather than any particular camp. The findings in this paper demonstrate that childcare assistance is a residence incentive that women will map onto when not overwhelmed by other factors. This understanding is an important step towards describing residence variability. In particular, the opposing residence effects of young children and older daughters may help explain one commonly observed pattern in societies practicing "flexible" residence.

Women often remain with their families early in their reproductive career but then later move away. This pattern is seen across a wide variety of societies, but is particularly common among foragers and other groups with limited access to material wealth [112, 48, 53]. Participant reports often associate this pattern with young mothers needing the childcare assistance of their family [113], but the logic of this explanation is not immediately intuitive. Young mothers may benefit more from the childcare assistance available in their natal residence due to the costs associated with maternal inexperience [114]. However, women's demand for assistance is likely to increase rather than decrease as they progress through their reproductive careers and accrue children. The key to solving this riddle may lie in looking not just at changes in the need for care but also changes in the source of care and how different sources create different residence incentives. I show in the previous chapter that we can expect care from older sisters to replace care from the maternal grandmother and aunts as a woman progresses through her reproductive career, thus shifting the dependence on assistance from relatives tied to the maternal camp to a portable source of care. This paper's findings are consistent with that explanation.

The Twe add an interesting wrinkle to this pattern in that the majority of married

women move away from their family even when they are young. However, Twe women often delay marriage until they have a daughter old enough to act as a secondary childcare provider in their husband's household. The Twe have an unusually high rate of unmarried mothers and the trade-off between marriage and living near family may explain why. Strict adherence to a rule of virilocal residence makes sense in a population like the Himba where men control considerable resources and thus hold a dominant bargaining position. When there is a mismatch between the cultural expectations of marriage and the benefits that marriage offers, it may be advantageous for a woman to take lovers or have a stable but unofficial partner while remaining in her natal household until she is in a better position to move away from her mother.

Cooperative childcare is an influential factor shaping household composition, at least among the Twe and the Hadza [54]. However, not all women have the option of turning to their mother for assistance. This study only looked at women with living mothers, but 26% of Twe infants are born without a living maternal grandmother. Other factors including the presence of prefertile aunts, competition between cousins for the maternal grandmother's care, and the relative interest of the paternal grandmother were not addressed in this paper but should add to the variability of individual residence decisions based on childcare assistance. The relative availability of childcare assistance in the natal camp differs across women for many reasons and this is consistent with the by-participant random effects found in this study. These differences may offer an important tool for understanding not just the specific pattern of women moving away from home as they progress in their reproductive career, but also the highly variable residence patterns of women and married couples within the majority of foraging societies.

APPENDIX A

MAP

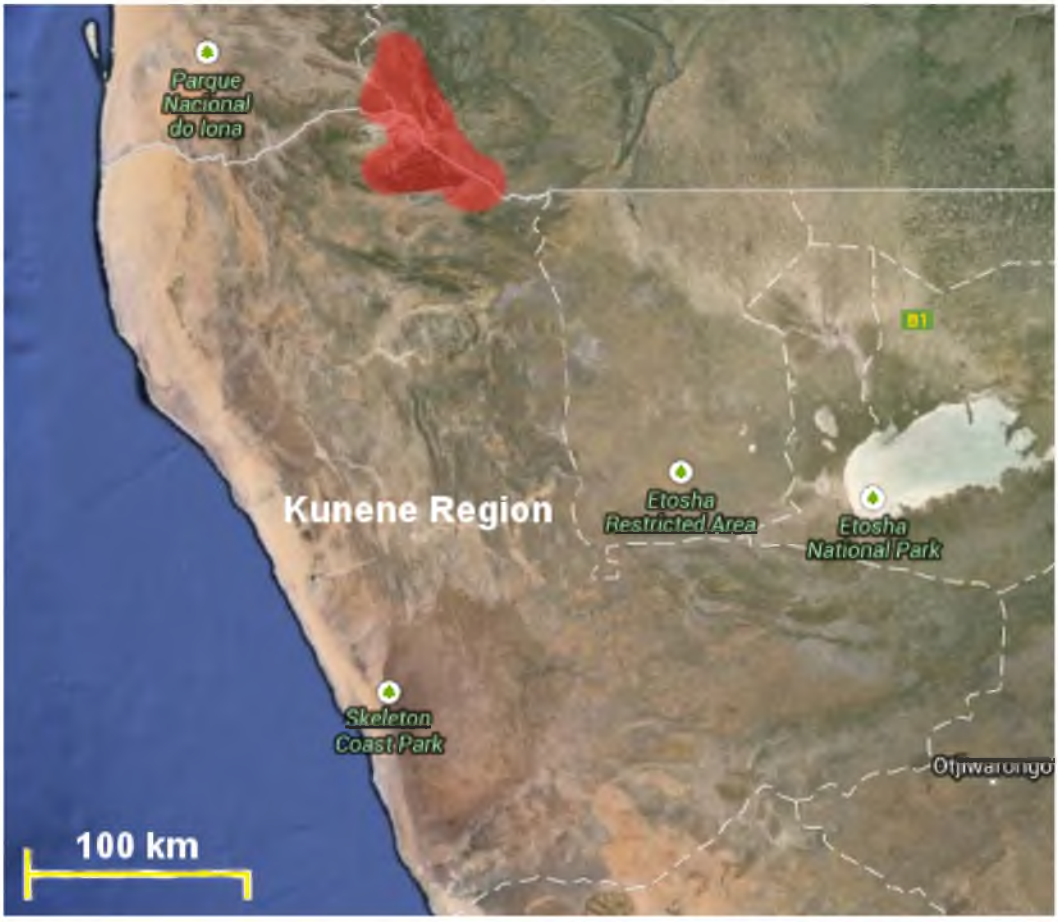

Figure A.1. Current distribution of Twe in region

Based on Twe camps identified during my fieldwork

APPENDIX B

TWE PHOTOGRAPHS

Figure B.1. Family garden

A young Twe couple in their household garden

Figure B.2. Twe man with bellows

Traditional Twe bellow called *omupepo*

Figure B.3. Twe men foraging

On the left are two men collecting palm wine. On the right are a father and son collecting honey.

Figure B.4. Twe couple in their household

Figure B.5. Twe childcaring unit

A young woman pregnant with her second child along with her mother and younger sister

Figure B.6. Children's dress

The girls 1st, 3rd, and 6th from the left are wearing traditional Twe outfits. The others are outfitted in various stages of typical Himba fashion. All of these girls will ultimately dress similar to the Himba once they reach reproductive maturity.

APPENDIX C

MANIPULATING PARAMETERS OF THE SIMULATION MODEL

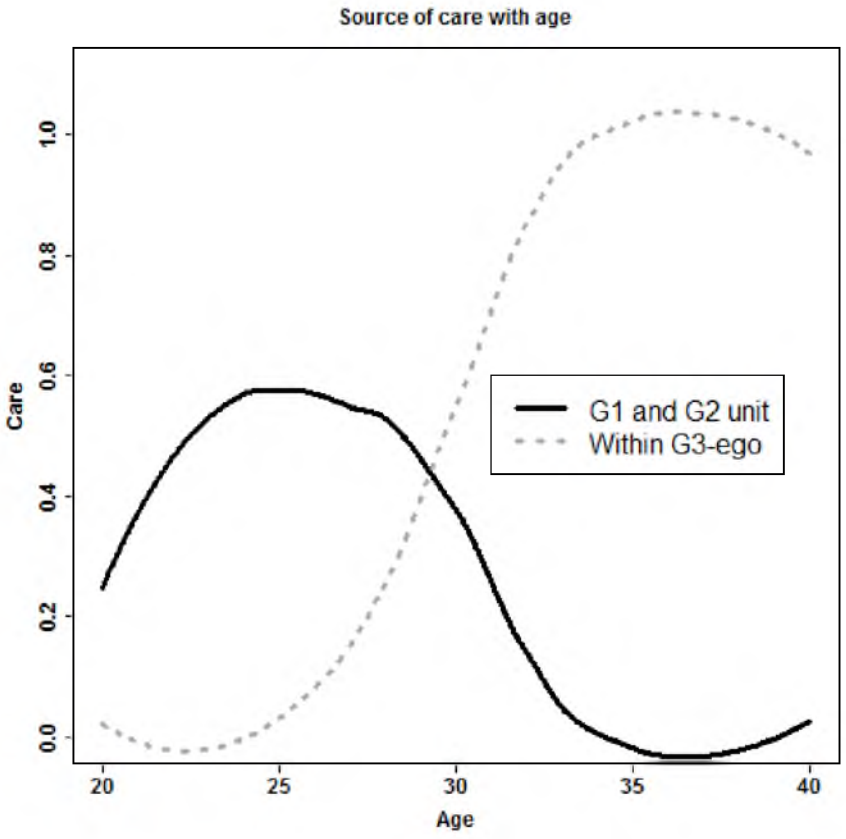

Figure C.1. Model output: With rate of reproduction doubled

Plot compares the mean amount of care distributed outside the focal unit to the amount of care given by older siblings across age.

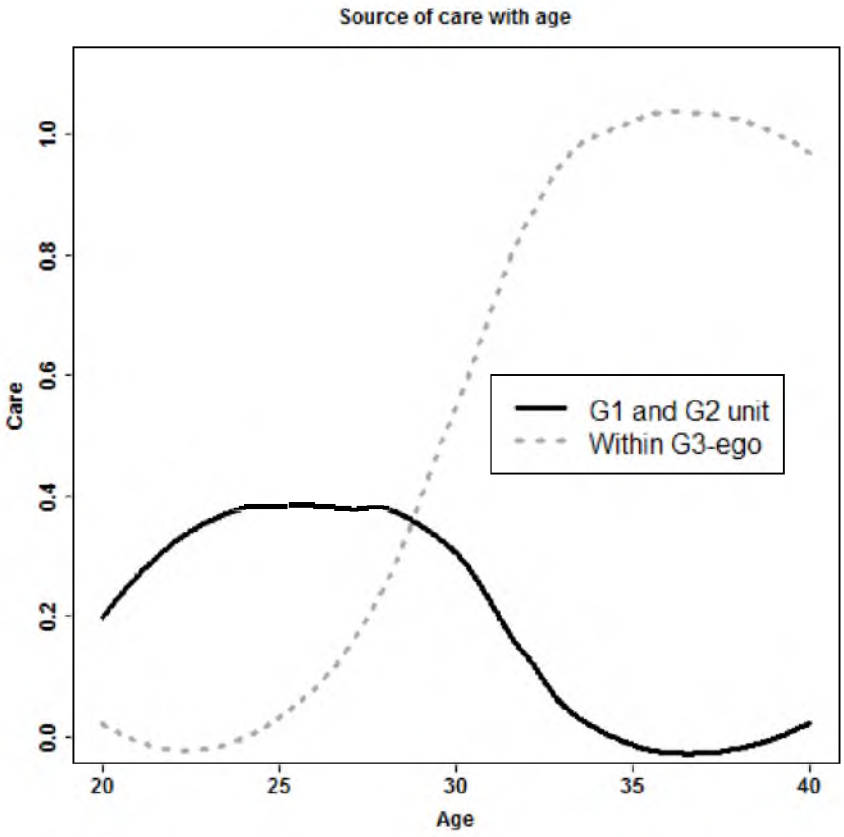

Figure C.2. Model output: With an additional sister

Plot compares the mean amount of care distributed outside the focal unit to the amount of care given by older siblings across age.

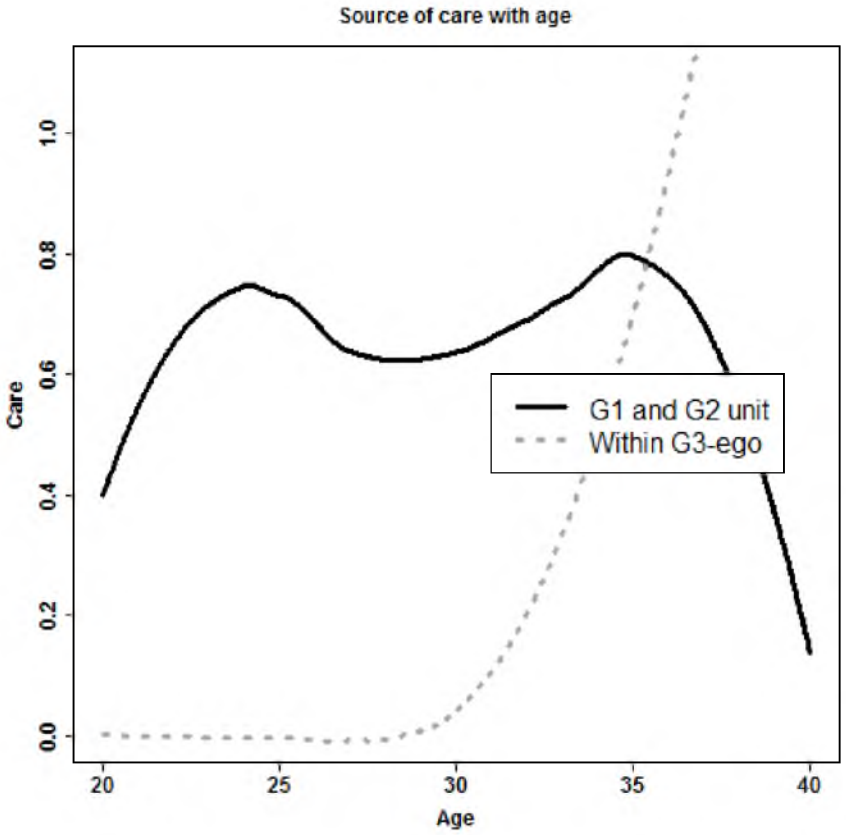

Figure C.3. Model output: Delaying transition from "needy" to "caring" until age 10

Plot compares the mean amount of care distributed outside the focal unit to the amount of care given by older siblings across age.

APPENDIX D

SIMULATION MODEL CODE

```
### Begin ###
# Draw care points from a normal distribution with mean = 2 and SD= 1
spr.set <- data.frame("ego" = NA, "mom" = NA, "age" = NA, "mom_giv" = 0, "mom_
    get" = 0, "sib_giv" = 0, "sib_get" = 0, "mgm_giv" = 0, "mgm_get" = 0, "ant
    _giv"= 0, "ant_get"= 0, "cuz_giv" = 0, "cuz_get" = 0)
age.efs <- data.frame("age"=0:99, "need"=c((5:1)/5, rep(0, 95)), "care"=c(rep
    (0, 5), (1:20)*0.05, rep(1, 75)))
baby.drw <- c(rep(1, 25), rep(0, 75))   # gives the odds of birth each year

for(r in 1:100){
fam <- data.frame(matrix(nrow=3, ncol=6))        # build the base dataset with
   mom and her three older daughers then columns to be filled
colnames(fam) <- c("ego", "mom", "mgm", "age", "need", "care")
fam[1,] <- c(1, 98, 99, 39, 0, 0)
fam[2,] <- c(2, 1, 98, 19, 0, 0)
fam[3,] <- c(3, 1, 98, 19, 0, 0)
#fam[4,] <- c(4, 1, 98, 19, 0, 0)

for(k in 1:21){ # this loop in responsible for generating each year
        fam$age <- fam$age + 1  # capures the aging across time
        for(i in 1:nrow(fam)){  # Here is where we add new kids which are born
            to women btw 20 n 40 every three years
                if(fam$ego[i] == 2 | fam$ego[i] == 3 & sample(baby.drw, 1) ==
                    1){                 #  Need to adjust IDs if +/- sisters.
                        fam <- rbind(fam, c(nrow(fam) + 1, fam$ego[i], fam$mom
                            [i], 0, 0, 0))
                }else{
                }
        }
        # set the distribution for how much care the women have to offer and
            draw a sample for this time set
        for(i in 1:nrow(fam)){
                fam$care[i] <- age.efs$care[age.efs$age == fam$age[i]]
        }
        for(i in 1:nrow(fam)){
                fam$need[i] <- age.efs$need[age.efs$age == fam$age[i]]
        }
        rcrds <- data.frame("ego" = fam$ego, "mom" = fam$mom, "age" = fam$age,
            "mom_giv" = 0, "mom_get" = 0, "sib_giv" = 0, "sib_get" = 0, "mgm_
            giv" = 0, "mgm_get" = 0, "ant_giv"= 0, "ant_get"= 0, "cuz_giv" =
            0, "cuz_get" = 0)
        if(sum(fam$need) > 0){
                cg <- subset(fam, care > 0)      # Isolate care givers
                cr <- subset(fam, need > 0)      # Isolate care recievers
                cmat <- data.frame(matrix(nrow = 0, ncol = 5))  # Build the
                    ranking matrix
                colnames(cmat) <- c("cg", "cr", "care", "need", "rel")
                for(j in 1:nrow(cg)){
```

```
            hld <- data.frame(cg$ego[j], cr$ego, cg$care[j], cr$
                need, NA)
            colnames(hld) <- c("cg", "cr", "care", "need", "rel")
            for(h in 1:nrow(hld)){
                    if(cg$ego[j] == cr$mom[h] | cg$mom[j] == cr$
                        mom[h]){
                            hld$rel[h] <- 0.5
                    }else if((cg$mom[j] == cr$mgm[h] | cg$ego[j]
                        == cr$mgm[h]) & cg$ego[j] != cr$mom[h]){
                            hld$rel[h] <- 0.25
                    }else{
                            hld$rel[h] <- 0.125
                    }
            }
            cmat <- rbind(cmat, hld)
    }
    while(sum(cmat$need) > 0 & sum(cmat$care) > 0){
            cmat <- subset(cmat, need > 0 & care > 0)
            rand <- sample(nrow(cmat))
            cmat <- cmat[rand,]
            cmat <- cmat[order(cmat$care, decreasing=T),]
            cmat <- cmat[order(cmat$need, decreasing=T),]
            cmat <- cmat[order(cmat$rel, decreasing=T),]
            cr.gv <- ifelse(cmat$need[1] > cmat$care[1], cmat$
                care[1], cmat$need[1]) # how much more is given?
            cmat$need[cmat$cr == cmat$cr[1]] <- cmat$need[cmat$cr
                == cmat$cr[1]] - cr.gv
            cmat$care[cmat$cg == cmat$cg[1]] <- cmat$care[cmat$cg
                == cmat$cg[1]] - cr.gv
            if(cmat$cg[1] == cr$mom[cr$ego == cmat$cr[1]]){
                                                # Is mom and kid?
                    rcrds$mom_giv[rcrds$ego == cmat$cg[1]] <-
                        rcrds$mom_giv[rcrds$ego == cmat$cg[1]] +
                        cr.gv
                    rcrds$mom_get[rcrds$ego == cmat$cr[1]] <-
                        rcrds$mom_get[rcrds$ego == cmat$cr[1]] +
                        cr.gv
            }else if(cg$mom[cg$ego == cmat$cg[1]] == cr$mom[cr$ego
                == cmat$cr[1]]){                        # is
                sibs?
                    rcrds$sib_giv[rcrds$ego == cmat$cg[1]] <-
                        rcrds$sib_giv[rcrds$ego == cmat$cg[1]] +
                        cr.gv
                    rcrds$sib_get[rcrds$ego == cmat$cr[1]] <-
                        rcrds$sib_get[rcrds$ego == cmat$cr[1]] +
                        cr.gv
            }else if(cmat$cg[1] == cr$mgm[cr$ego == cmat$cr[1]]){
                                                        # is
                granny and gkids?
                    rcrds$mgm_get[rcrds$ego == cmat$cr[1]] <-
                        rcrds$mgm_get[rcrds$ego == cmat$cr[1]] +
                        cr.gv
                    rcrds$mgm_giv[rcrds$ego == cmat$cg[1]] <-
                        rcrds$mgm_giv[rcrds$ego == cmat$cg[1]] +
                        cr.gv
            }else if(cg$mom[cg$ego == cmat$cg[1]] == cr$mgm[cr$ego
                == cmat$cr[1]] & cmat$cg[1] != cr$mom[cr$ego ==
                cmat$cr[1]]){ # aunty and nenes?
                    rcrds$ant_get[rcrds$ego == cmat$cr[1]] <-
```

```
                                        rcrds$ant_get[rcrds$ego == cmat$cr[1]] +
                                            cr.gv
                                    rcrds$ant_giv[rcrds$ego == cmat$cg[1]] <-
                                        rcrds$ant_giv[rcrds$ego == cmat$cg[1]] +
                                        cr.gv
                                }else{

                                                # is cuzs?
                                    rcrds$cuz_giv[rcrds$ego == cmat$cg[1]] <-
                                        rcrds$cuz_giv[rcrds$ego == cmat$cg[1]] +
                                        cr.gv
                                    rcrds$cuz_get[rcrds$ego == cmat$cr[1]] <-
                                        rcrds$cuz_get[rcrds$ego == cmat$cr[1]] +
                                        cr.gv
                                }
                        }
                        for(g in 4:ncol(rcrds)){
                        rcrds[2,g] <- rcrds[2,g] + sum(rcrds[,g][rcrds$mom == rcrds$
                            ego[2]])
#                       rcrds[3,g] <- rcrds[3,g] + sum(rcrds[,g][rcrds$mom == rcrds$
    ego[3]])
#                       rcrds[4,g] <- rcrds[4,g] + sum(rcrds[,g][rcrds$mom == rcrds$
    ego[4]])
                        }
                        for(g in 2:3){
                                if(length(rcrds$ego[rcrds$ego[g] == rcrds$mom]) > 0){
                                        spr.set <- rbind(spr.set, rcrds[g,])
                                }
                        }
                }else{
                }
}
}
spr.set <- spr.set[-1,]

#### END ######
```

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